

H-Beam Instability in FNAL Linac

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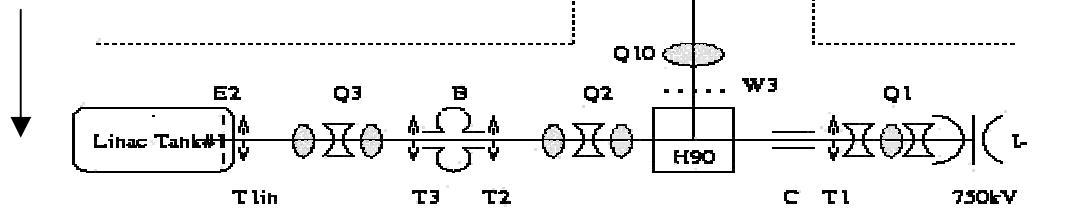
Experimental Setup

H-Source

750keV Transfer Line

- B Buncher
- C Chopper
- E Emit. Probe
- H Dipole
- T Toroid
- W Wire
- F Quad in H plain
- D Quad
- Trim

BPM after Tank#2



Aug-2000

Linac 2000

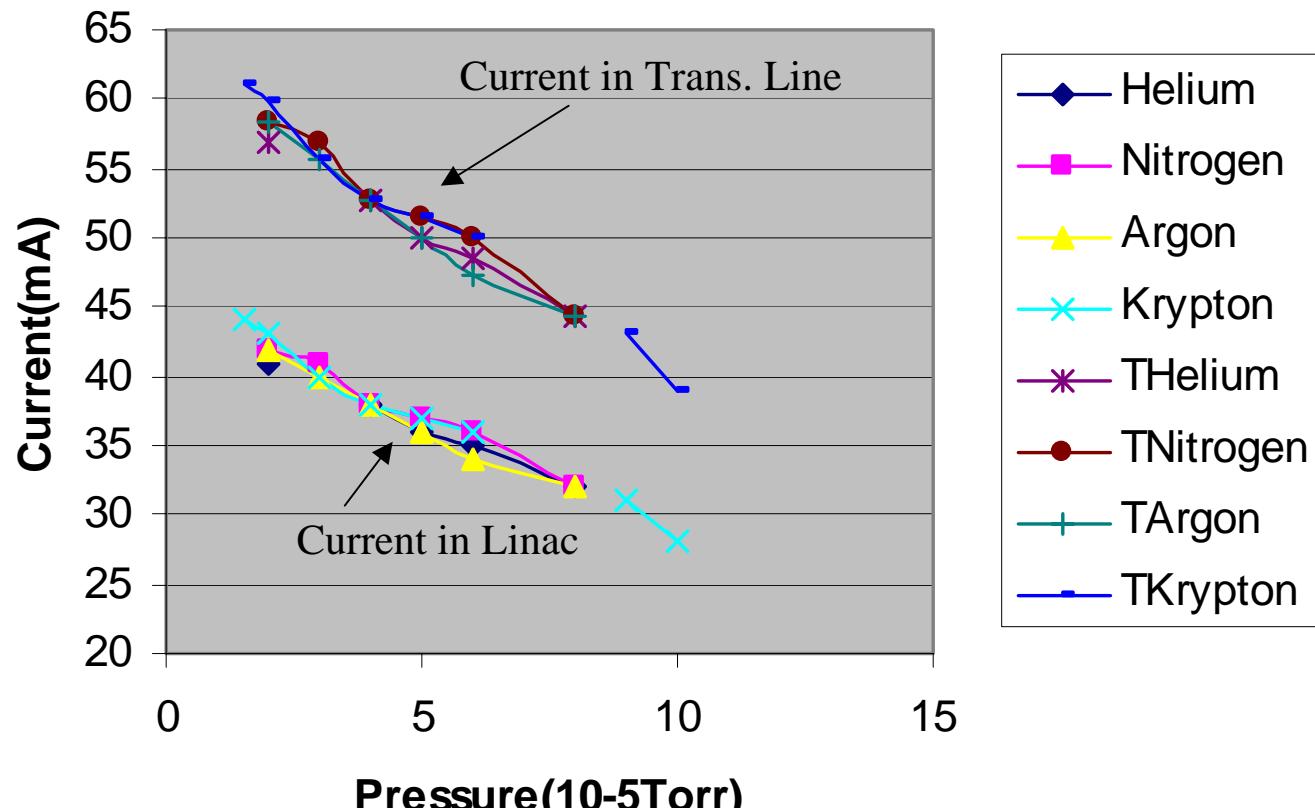
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1-March'95

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Gases and Pressure in Transfer Line

- Hydrogen, pressure 10^{-5} torr
- Helium, pressure in range, 10^{-5} to 10^{-4} torr
- Nitrogen, pressure in range, 10^{-5} to 10^{-4} torr
- Argon, pressure in range, 10^{-5} to 10^{-4} torr
- Krypton, pressure in range, 10^{-5} to 10^{-4} torr

LinCurr,TranLineCurr&Pressure



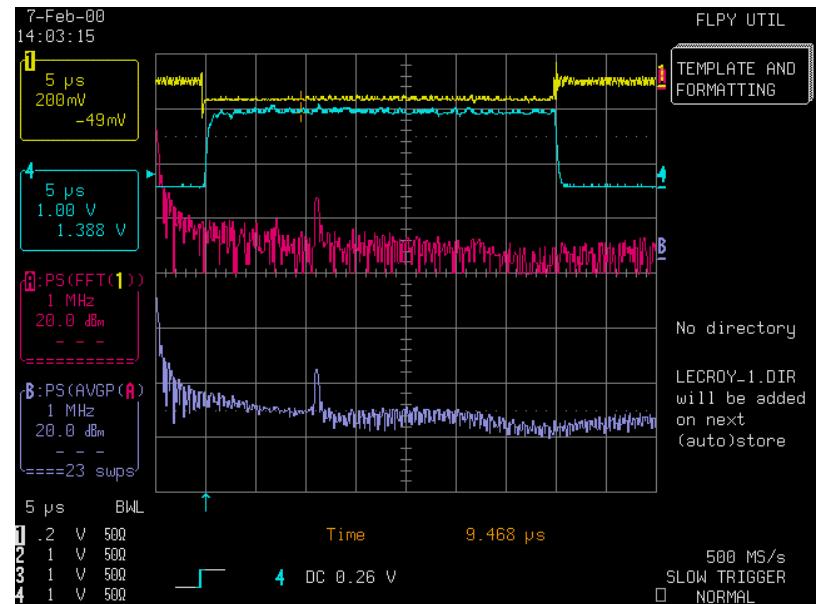
Beam Parameters

(Normal Operations)

- Pulse Length $35\mu\text{s}$
- Peak Current 49mA in the Linac
- Pressure, 2.8×10^{-6} Torr with Ion Pump ON
- Background gas in the line is Hydrogen from the Ion Source
- Average Beam Size in Tran Line, $R = 1.2\text{ cm}$

Scope Traces

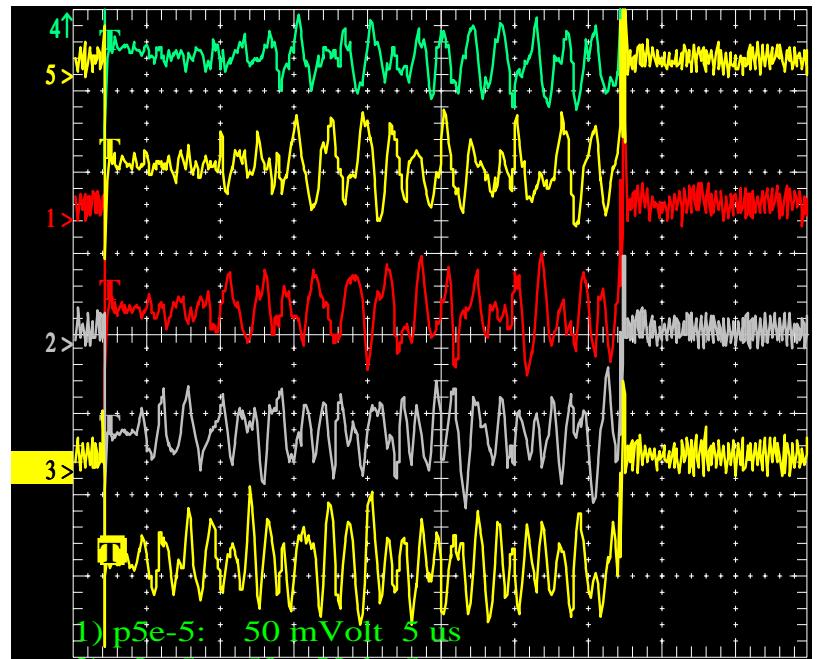
- Yellow, BPM signal
- Blue, Toroid signal
- Purple, FFT of BPM signal
- Blue, Average FFT
- Only last 20 μ s of beam was FFT analyzed



Scope Traces

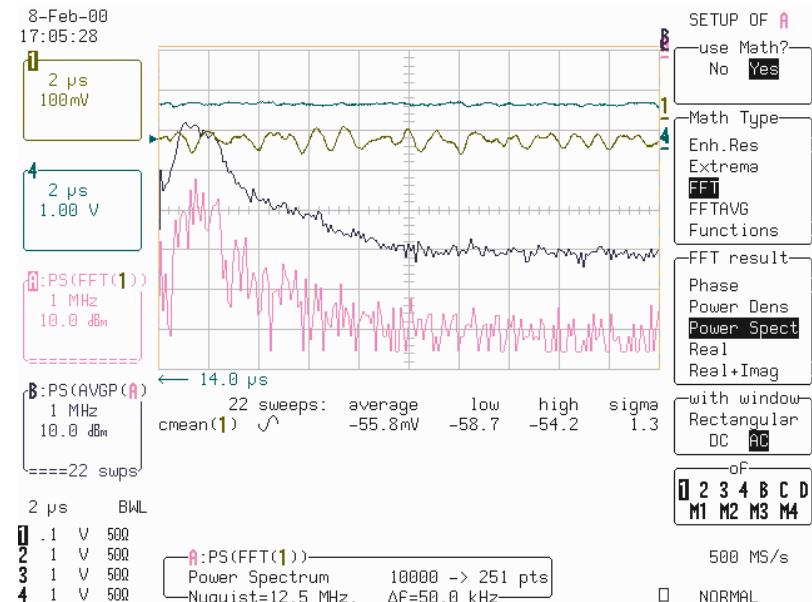
Argon Gas, Instability formation and Freq. as function of Pressure

- Green, 3e-5
- Yellow, 4e-5
- Red, 5e-5
- Grey, 8e-5
- Yellow 10e-5



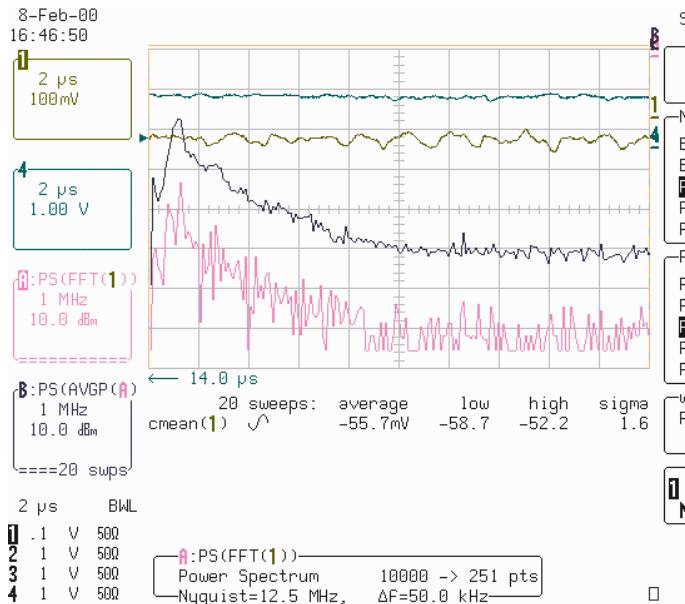
Argon at 6e-5 torr

- Two res freq are clearly visible only at narrow pressure range
- 0.55MHz and 1.1MHz
- Lower Freq present at lower gas pressure
- Higher Freq starts at higher gas pressure
- Broad freq peak

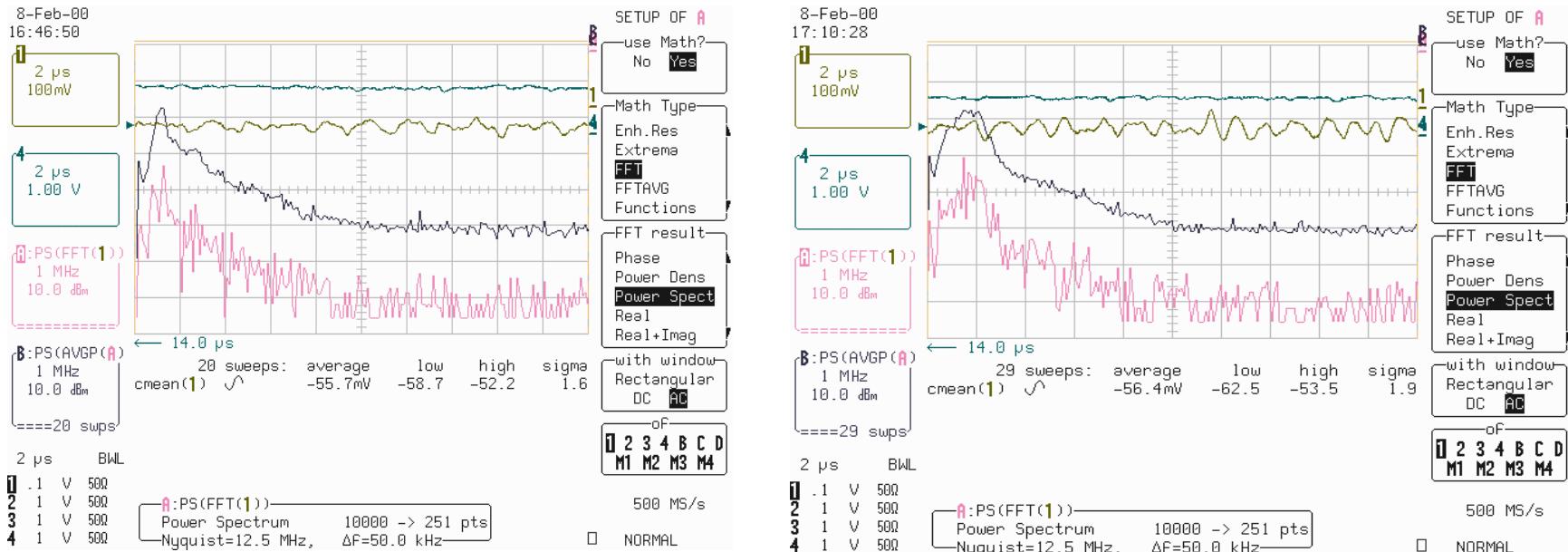


Argon

Pressure 3e-5, Current 40mA

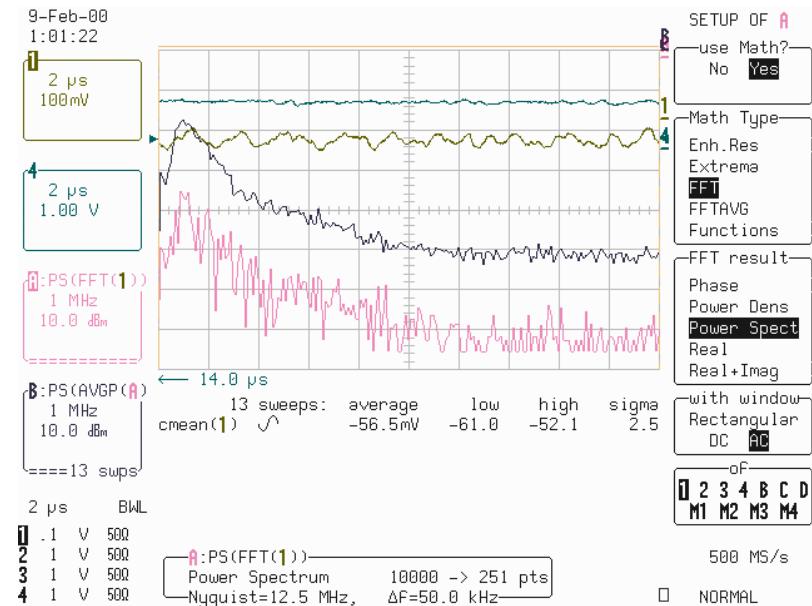


Pressure 8e-5, Current 32mA



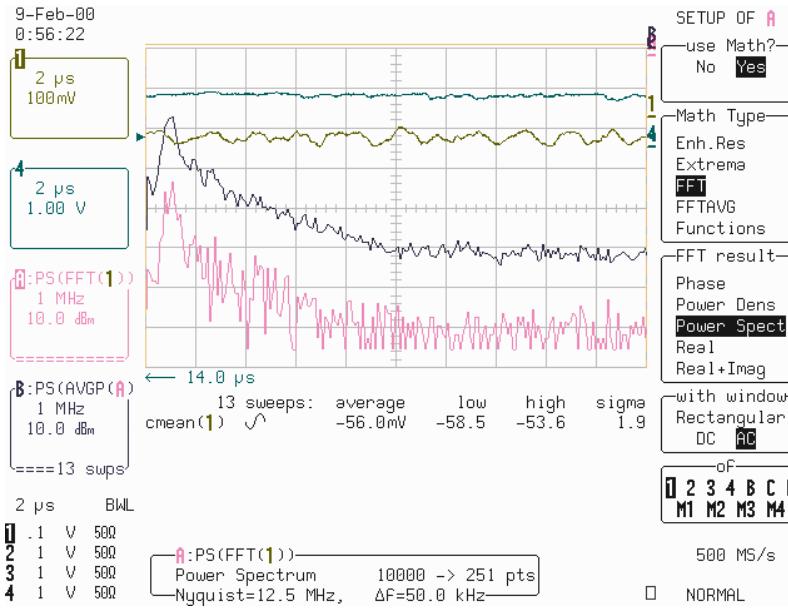
Krypton at 5×10^{-5} Torr

- Two res freq are visible only at narrow pressure range
- 0.5MHz and 1.0MHz
- Lower Freq present at lower gas pressure
- Higher Freq starts at higher gas pressure
- Broad freq peak

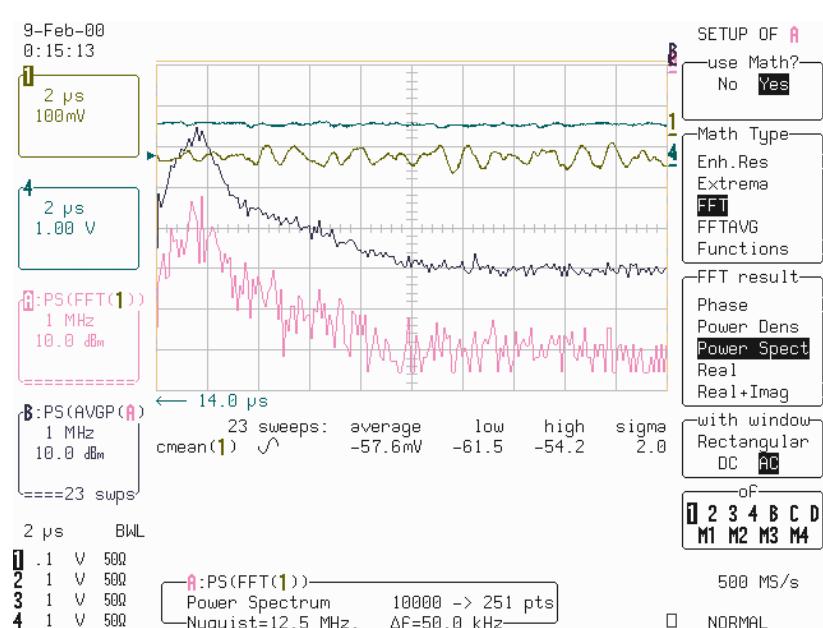


Krypton

Pressure 3e-5, Current 40mA



Pressure 9e-5, Current 32mA



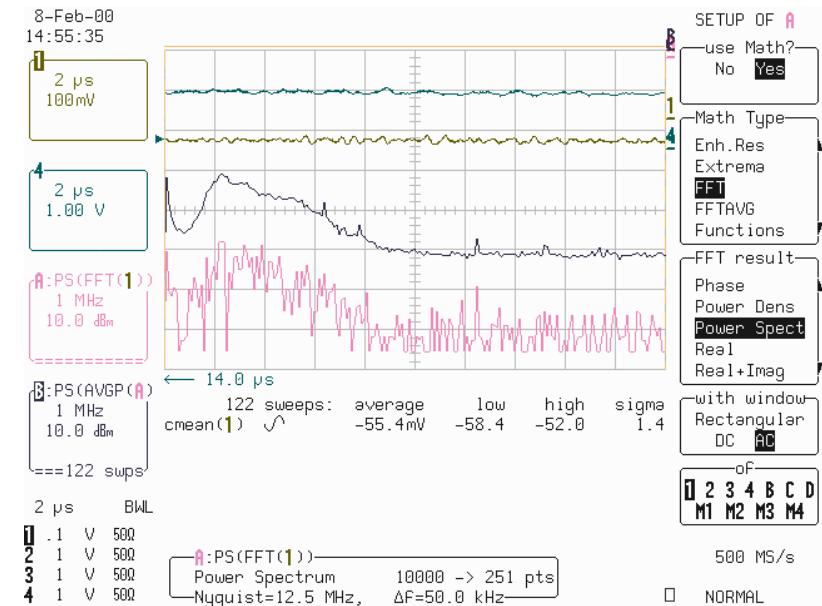
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Linac 2000

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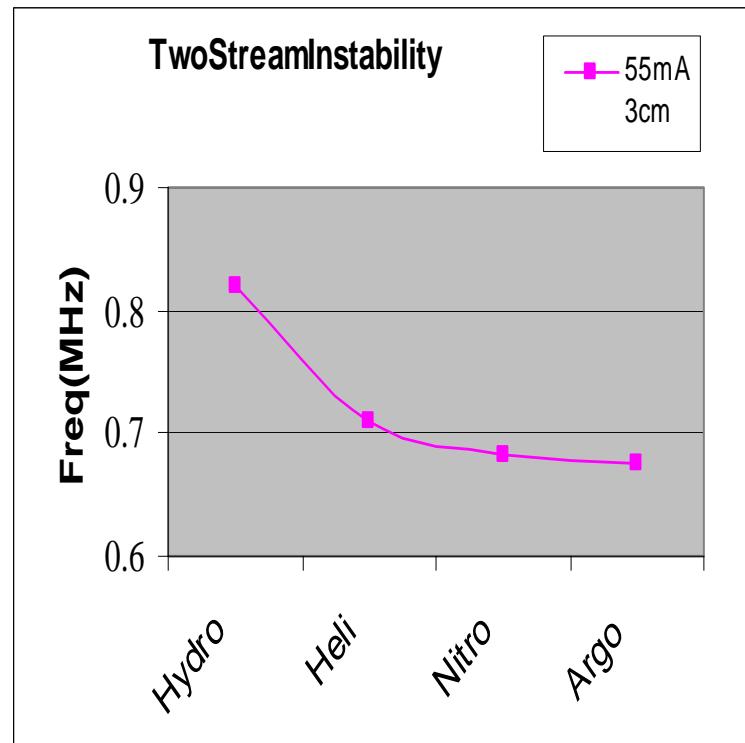
Hydrogen at 10^{-5} Torr

- Hydrogen Gas
- Single peak at 1.1MHz
- Peak Current 43mA



Estimated Plasma Frequency

Low Gas Pressure $\sim 3 \times 10^{-5}$ Torr



High Gas Pressure $\sim 8 \times 10^{-5}$ Torr

